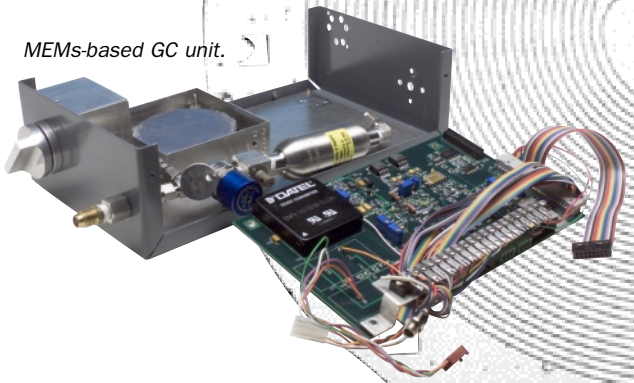
The Lawrence Livermore National Laboratory (LLNL) developed a prototype GC-based system that is:

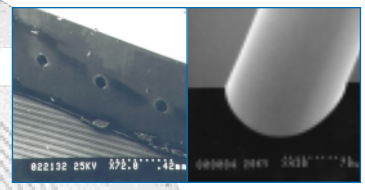
- Miniature—hardback-book size
- Low-power and portable
- Self-contained
- Based on microelectromechanical systems (MEMS) technology

Possible applications include:

- Traditional GC operations
- "Smart-sensor" applications for
  - Air quality monitoring
  - Manufacturing process control
  - Emission control
  - Plus numerous others



MEMs-based GC unit.



Left: Cross-section of bonded silicon column. Right: Semi-circular etch column before the two halves are bonded together.

The column for the miniature gas chromatograph has been reduced to two silicon wafers bonded together. Pictured in the background, one wafer is shown with its coiled groove 100 micrometers wide and several meters long.

This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

ENGINEERING @ LLNL

* LLNL is currently looking for industrial partners to assist in the commercialization of this and other technologies. Please note that this is not an offer for sale, but an advertisement of available technology for commercialization.

For information regarding partnering opportunities with LLNL Engineering on the GC system or other technologies, contact:

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UCRL-TB-129689 Rev 1

New Enhanced

Hand-Held Gas Chromatograph

On-the-spot chemical analysis—could this technology* benefit your company?

Prototype Nominal Technical Specifications

Sampling

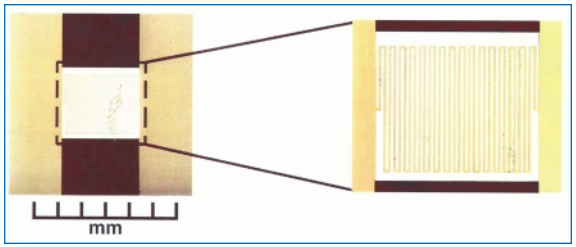
- System accepts gas and liquid samples
- System analyzes gas samples containing compound mixtures with boiling points up to 200 °C
- Analysis Time: 30 to 40 seconds for light gases

Detectors (MEMS-based)

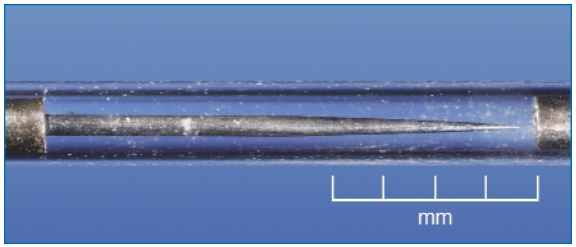
- Thermal conductivity detector (sensitivity: 1 ppm for many compounds)
- Glow discharge detector (sensitivity: 35 ppb for many compounds) NEW

Injector System

- 1-2 µL injection volume
- Manual injection (syringe)
- Internal sampling loop ensures a precise sample volume for each cycle



Thermal conductivity detector.



Glow discharge detector.

Injector Heater

- Temperature range: 25 °C to 150 °C

Column (MEMS-based)

- High temperature fusion bonded silicon construction
- Cylindrical column 5 meters long and 100 microns in diameter (additional lengths and/or diameters are available)
- Column coatings: DB-1, DB-5, DB-54, and DB-wax are available
- Column operating temperature: 25 °C to 250 °C

Column Heater (MEMS-based)

- Temperature range: 25 °C to 300 °C isothermal or programmable

Carrier Gas

- Self-contained supply: He, H_2 or N_2 Gas is stored in a refillable 40 mL tank at 1000 psi. Carrier gas supply will last for 6 hours of continuous sampling.

Power

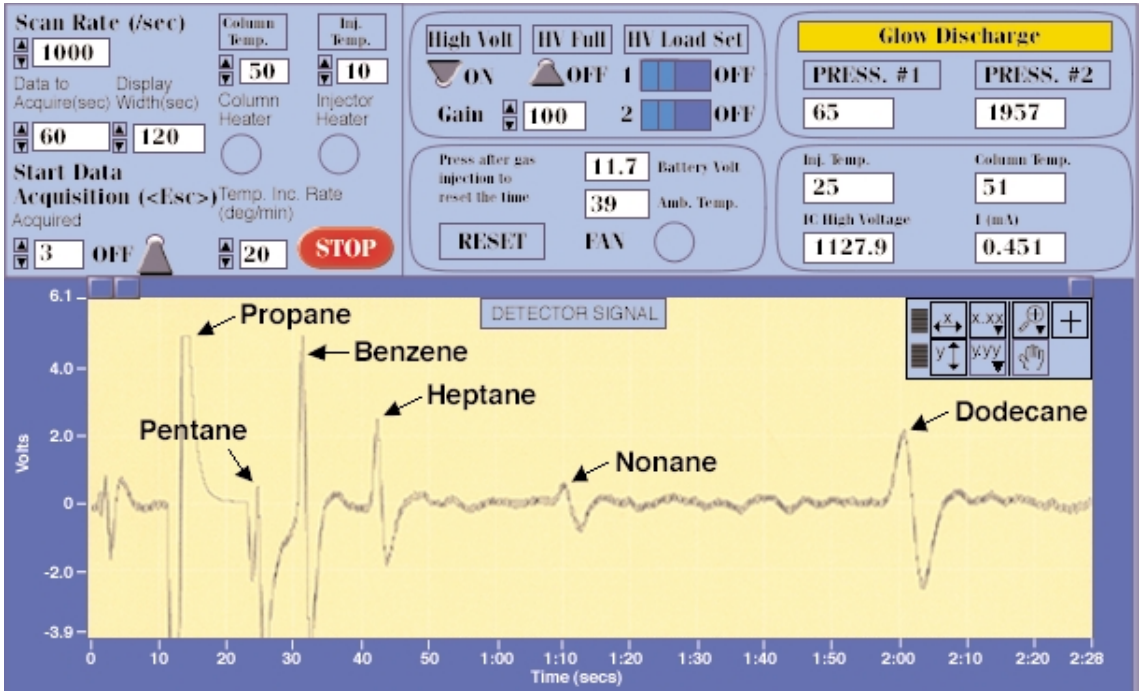
- System: 12 VDC, 24 watts maximum
- Battery: Rechargeable internal 12 VDC will last for 2 hours of continuous sampling between charges

Physical

- Dimensions: 8" x 5" x 3"
- Weight: 8 lbs.

User Interface

- On-board commercial palm-top computer



Real-time chromatogram of a 1 ppm C_3 to C_{12} sample gas mixture using hand-held gas chromatograph with glow discharge detector.